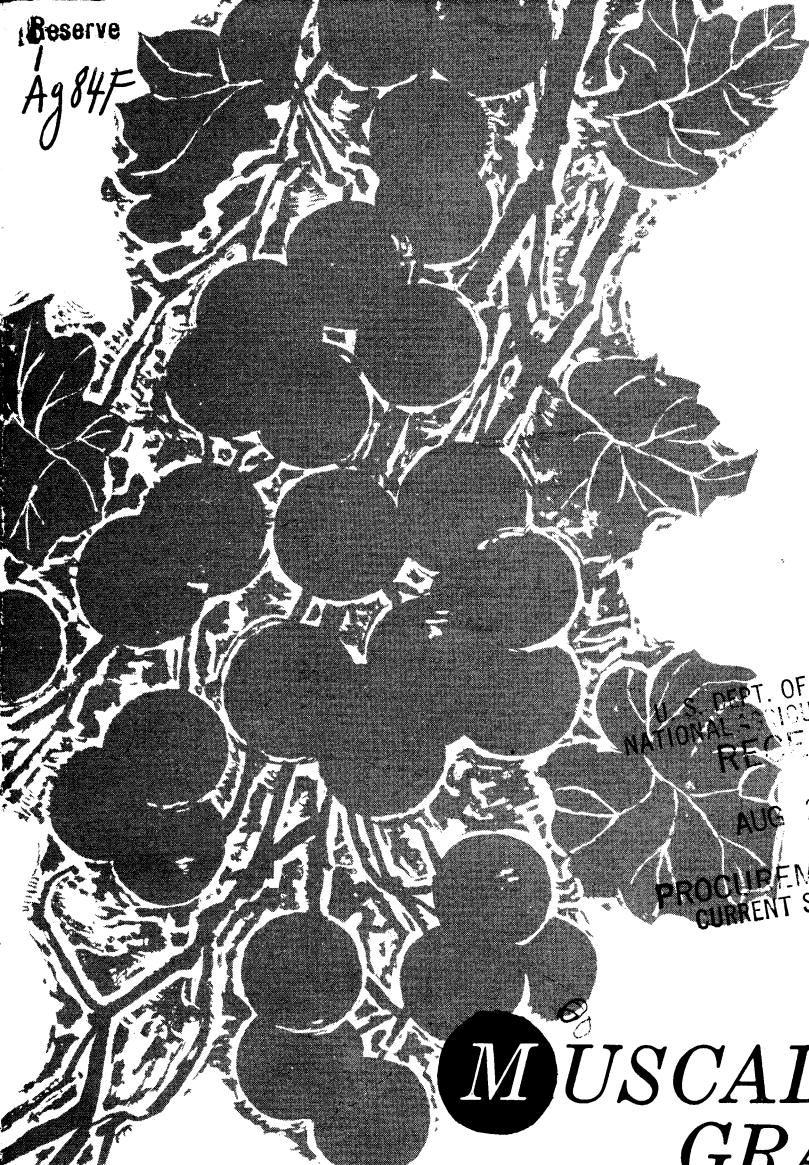


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MUSCADINE GRAPEs

a fruit for the South

FARMERS' BULLETIN NO. 2157
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U.S. DEPARTMENT OF AGRICULTURE

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Plant Science Research Division
Agricultural Research Service

Washington, D.C.

Revised July 1971

MUSCADINE GRAPE\$

a fruit for the South.

Muscadine grapes¹ are prized as fresh fruit in the region where they are grown. They also are used for unfermented juice, pies, jellies, sauces, and wines. Muscadine wines have a distinctive flavor, and are sold primarily to a specialty trade. Fruit marketed fresh generally is sold locally, because flavor and aroma deteriorate rapidly under the usual methods of handling.

This fruit is a favorite for home planting because it is seldom seriously affected by diseases or insects, and control measures are seldom needed.

Yields vary widely. Some of the factors that affect yield are variety, vineyard care, pruning, fertilization, and weather. Production in commercial vineyards generally is between 2 and 4 tons per acre. Many vines yield more than a bushel each.

ADAPTATION

Muscadine grapes are most likely to succeed in the region shown in figure 1; they are native to much of

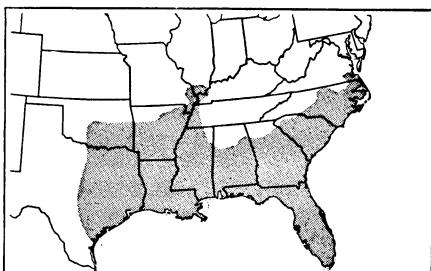
¹ The three species of muscadine grapes are *Vitis rotundifolia*, *V. munsoniana*, and *V. popenoei*. Most of the varieties cultivated in the United States, and all those described in this bulletin, are *V. rotundifolia*.

this region. Temperatures in most of the region seldom go lower than 10° F., and rarely go as low as 0°.

The minimum temperature the vines can withstand depends largely on weather conditions preceding low temperatures. Vines hardened by gradually lowering temperatures over a period of several weeks have survived at -10° F., but damage often occurs at higher temperatures if there is a sudden drop in temperature.

These grapes bloom late in the spring and are seldom seriously injured by late frosts.

Muscadine vines are adapted to almost any well-drained, fairly fertile soil. They do not thrive in low wet soils or on barren clay hills. Planting is not recommended where



BN-12145-X

Figure 1.—Shaded part of map indicates area of adaptation for muscadine grapes.

there is a hardpan or water table near the surface.

Sites for muscadine grapes should receive full sunlight. Wild vines grow in the woods, but all the new growth is in the treetops, where the vines are exposed to the sun.

DESCRIPTION

Fruit clusters are short and nearly round. Usually there are 4 to 15 berries, but sometimes there are many more, particularly in the perfect-flowered types.

Flowers may be pistillate (female), staminate (male), or perfect (hermaphroditic), the type depending on variety. The staminate types produce no fruit. The three flower types are shown in figure 2.

Berries are round or oval and range from three-eighths of an inch to more than 1 inch in diameter. They are green, pearly white, bronze, red, or black; frequently they are speckled or dotted. The skin is relatively thick and tough, or even leathery. The pulp ranges from meaty to melting and juicy. The number of seeds ranges from one to eight; usually there are two to four.

Flavors of the different varieties range from very sweet to very acid, from musky to no muskiness, and

from fruity and tangy to mild and bland.

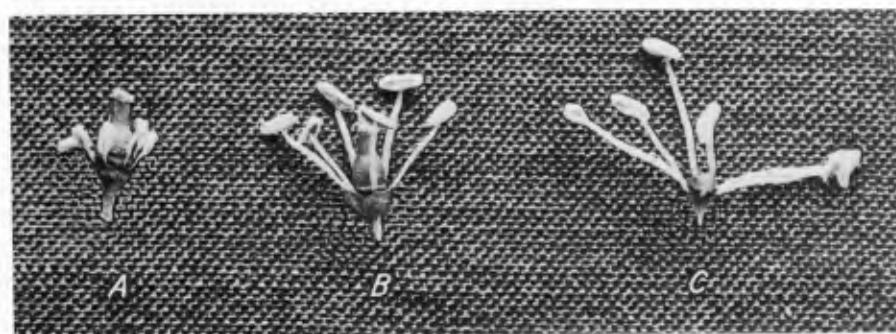
Wood is comparatively hard. Bark adheres closely to the young branches, but it sheds from the older wood. Tendrils are simple and unbranched.

VINE GROWTH

Vines growing wild become dense, tangled masses. The form of cultivated vines varies with training and pruning methods; but the basic framework consists of the main stem, or trunk, and the main branches, which are known as fruiting arms. Buds, from which new growth arises, may occur at any place on the vine, but usually they occur on the newer parts. For clarity in the following discussion, branches arising from the buds are called shoots for the first season of their growth; after the first year, they are called canes.

Shoots bear the fruit. Usually, only those that arise from buds on the previous year's growth are fruitful.

After the vine starts bearing fruit, the fruit-bearing shoots are cut back during the dormant season to stubs 2 to 4 inches long. These stubs, called spurs, have several buds that produce new fruit-bearing shoots the following season. As



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Figure 2.—Blossoms showing typical characteristics of three muscadine grape flower types: A, pistillate; B, perfect; C, staminate.

the shoots are pruned back to spurs in successive years, and the spurs give rise to more shoots, a growth that originally was a single spur becomes a many-branched appendage known as a spur system.

PROPAGATION

If you want only a few vines for home planting, propagation is hardly worthwhile; it is better to buy plants from a reliable nursery. If propagation is considered worthwhile, it may be done by layering or by taking cuttings.

Layering

Layerage is the most widely used method of propagation. A layer is a branch or shoot that is covered with soil. The covered part puts out roots, and when cut off from the mother vine and transplanted, starts a new vine.

There are several methods of layerage. Following are instructions for one of the most commonly used methods.

Start layers in late June or July. If only a few plants are wanted, select strong shoots or young canes that can be laid on the ground. If many plants are wanted an entire main branch, or fruiting arm, can be used. Lay the cane or arm in a shallow trench; hold it in place with pegs if necessary. Cover with 4 or 5 inches of soil after stripping all the leaves from the parts of the shoots that will be covered. Leave foliage on the uncovered parts of the shoots, the ends of which should protrude from the soil. When an entire arm is used, the older wood and base of the shoots will be covered with soil.

Roots will grow from the covered part of the shoots. During the following winter separate the rooted layer from the mother plant by cutting the layer off about 2 inches from the main branch. Remove the

layer carefully; try not to do extensive damage to the roots.

Well-rooted plants may be planted directly in the vineyard in their permanent locations. Lightly rooted ones should be grown in a nursery area for one year. An area in the garden that is protected from wind and has good garden soil will serve satisfactorily as a nursery.

When transplanting plants into the nursery or the vineyard, set them so the ground line is about where it was when the shoot was layered.

Taking Cuttings

Muscadine grapes may be propagated with softwood cuttings taken during the growing season, or with hardwood cuttings taken during the dormant season. Propagation from dormant cuttings usually is not satisfactory and is seldom used.

One of the most successful methods of handling softwood cuttings is propagation with mist during the first 6 to 8 weeks to maintain high humidity. This is the only method of propagation by cuttings that is discussed in this bulletin.

Removing softwood cuttings

Early in the growing season—June is usually the best time—select vigorous shoots for use as cuttings. Cut off and discard the tender tips of the shoots. Make cuttings of the rest of the shoot, with three or four nodes on each cutting. Most cuttings will be 4 to 6 inches long, but may be longer if growth is exceptionally vigorous. Two to four cuttings can be made from each shoot. Keep the cuttings moist from the time they are cut until they are lined out in the cutting bed.

Lining out cuttings

The bed in which the cuttings are lined out must be well drained and

well aerated. A good bed is made by placing coarse sand, or a mixture of sand and peat, in a raised bed that has a floor made of wire screen. Make a windbreak 2 or 3 feet high around the edges of the bed with boards or burlap. Locate the beds where they are in full sunlight or light shade.

Line the cuttings out as quickly as possible after they are cut. Set them vertically in the bed, with about half their length below ground. Another guide to depth of setting is two nodes above ground and two below. Strip all the foliage from the part that is to be buried.

Maintaining humidity

Various methods are used to maintain humidity. One way is to supply mist with fine-aperture nozzles that deliver about 2 gallons of water per hour at 30 pounds' pressure. Nozzles are spaced so mist is evenly distributed over the entire bed.

Excess mist can waterlog the plant bed. To prevent it, operate nozzles intermittently with devices that are available for this purpose. An electric time clock that will turn water on and off by means of a solenoid valve is probably the simplest and most satisfactory device.

The best time interval for misting depends on local conditions. Cuttings should not be permitted to wilt. To prevent wilting, keep humidity high at all times. Maintain humidity with frequent mistings of short duration, rather than with infrequent mistings of long duration. With an effective windbreak and very light shading, a misting of 6 seconds' duration every 2 minutes has been satisfactory.

Do not apply mist during the night and on days when natural humidity is high.

Keep up the mist application long enough to give cuttings time

to root and to start new shoot growth—usually 6 to 8 weeks.

The amount of water to apply directly to the bed during this time depends on weather conditions, type of material in the bed, and bed drainage. Usually, the misting supplies all the water that is needed. Apply only enough to keep the roots moist and prevent wilting; do not saturate the bed.

Feeding the cuttings

Start feeding the cuttings with a soluble fertilizer about 2 weeks after they have been lined out. To prepare the solution, mix 1 tablespoon of 20-20-20 starter fertilizer with each gallon of water. Apply 2 gallons to each 10 square feet of plant bed every ten days.

Hardening the cuttings

Plants rooted under mist are very tender, and they must be hardened gradually to insure continued growth. The proper method of hardening depends on where the plants will be grown for the rest of the season.

If the plants are to be left in the plant bed until fall, gradually reduce misting over a period of about 14 days, then stop misting. The amount of water applied to the bed may also be reduced during the hardening period, but do not stop watering; give the plants enough water to prevent wilting.

If the plants are to be potted, reduce misting and watering for a few days—do not stop misting as you would do if the plants were to be left in the beds.

Handling rooted cuttings

The choice of leaving cuttings in the bed until fall or transferring them to pots may depend on the space and equipment available. Generally, fewer plants will die and

the plants will get bigger if they are left in the beds.

Plants left in the beds will require little care except watering and fertilizing. Give them enough water to keep the soil moist; do not saturate the soil. Continue feeding with soluble fertilizer until early or mid-September.

If you cannot leave plants in the bed, transplant them to pots containing friable, well-drained loam. Keep them under high humidity and partial shade as long as they are in the pots. Leave them in the pots until they form strong root balls—usually about a month—then, line them out in an area of the garden where they will be protected from the wind, and where the soil is well worked and well-drained. Follow the watering and fertilizing methods described above for plants left in the beds.

If cuttings taken from vigorous vines in early June are properly handled, over 90 percent of them will root.

TRAINING SYSTEMS

Training is the planned placement of the vine on a supporting structure such as a trellis or arbor. Several training systems are used. Only two of the most satisfactory—the vertical trellis and the overhead arbor—will be described.

Vertical Trellis

A vertical trellis is easier and cheaper to erect than an overhead arbor. Vertical trellises may be 1-wire or 2-wire. Harvesting is easier with a 1-wire trellis, but yields are a little lower.

With vertical trellises, vines are trained with one arm in each direction for each wire—there are two arms for a 1-wire trellis and four arms for a 2-wire trellis.

Set posts for a vertical trellis in rows at least 10 feet apart. Space

posts in the rows 15 to 20 feet apart for a 2-wire trellis, and 20 to 25 feet apart for a 1-wire trellis. If one wire is used, place it near the top of the post. If two wires are used, place the lower wire about $2\frac{1}{2}$ feet from the ground. Posts should extend 5 feet above ground. Strongly brace end posts.

If the young vines are planted out before the trellis is built, set posts directly in line with the rows of plants and midway between vines.

Overhead Arbor

An overhead arbor requires longer posts and more wire per vine than a vertical trellis. But with an overhead arbor, the vineyard can be cross-cultivated and each vine has more fruit-bearing surface. Fruit on an overhead arbor is easier to harvest than fruit on a trellis, because it is easier to see.

Set posts 15 feet apart in each direction for an overhead arbor. Posts should extend 7 feet above ground. Strongly brace or guy the end posts. Stretch wires across the tops of posts so they radiate in eight directions—lengthwise, crosswise, and diagonally—from the top of each post.

In an overhead arbor, the vine is trained to a single vertical trunk, which is supported by the arbor post. When the trunk reaches the top of the post it is cut off to cause branching. Single canes are then trained on each wire until all eight canes are established.

PLANTING

Vines can be planted in the permanent vineyard any time during the dormant season. From the time the vines are dug up until they are set in their permanent locations, protect the roots from drying. Wrap the vines in wet burlap or

keep the roots in creamy mud during this time. Before planting the vine, prune it to one strong stem.

Setting

Make the hole wide enough to allow roots to spread out naturally, and deep enough to permit planting the vines about 2 inches deeper than they grew in the nursery.

Fill in around the roots with good topsoil, and firmly pack the soil as the hole is filled. After planting, shorten the stem to 6 to 8 inches.

Spacing

If the vines are to be trained to an overhead arbor, set the permanent posts before planting the vines. Spacing posts about 15 feet apart each way is usually satisfactory for an overhead arbor. Plant each vine close to a post. Do not use treated posts; the chemical used for treating posts is poisonous to plants.

If vines are to be trained to a vertical trellis, setting the posts before planting is not necessary if the vines are properly spaced and alined so they will be directly under the wires when the trellis is built. Plant vines in rows at least 10 feet apart. Space the vines 15 to 20 feet apart in the row if they are to be trained to a 2-wire trellis, and 20 to 25 feet apart if they are to be trained to a 1-wire trellis. Set a 5-foot stake by each vine at planting time and leave it in place the first 2 years to aid in developing a straight trunk. If the trellis is built before planting, set plants midway between posts.

Plant mainly pistillate types; plant only enough vines of perfect-flowered types to pollinate the pistillate vines. Pollinating vines should be within 25 feet of the pistillate vines. Where only a single row is planted, every third vine

should be a pollinizer. In larger vineyards, every third vine in every third row should be a pollinizer. Wild stamineate vines in areas adjacent to the vineyard are seldom close enough to be satisfactory pollinizers.

PRUNING AND TRAINING

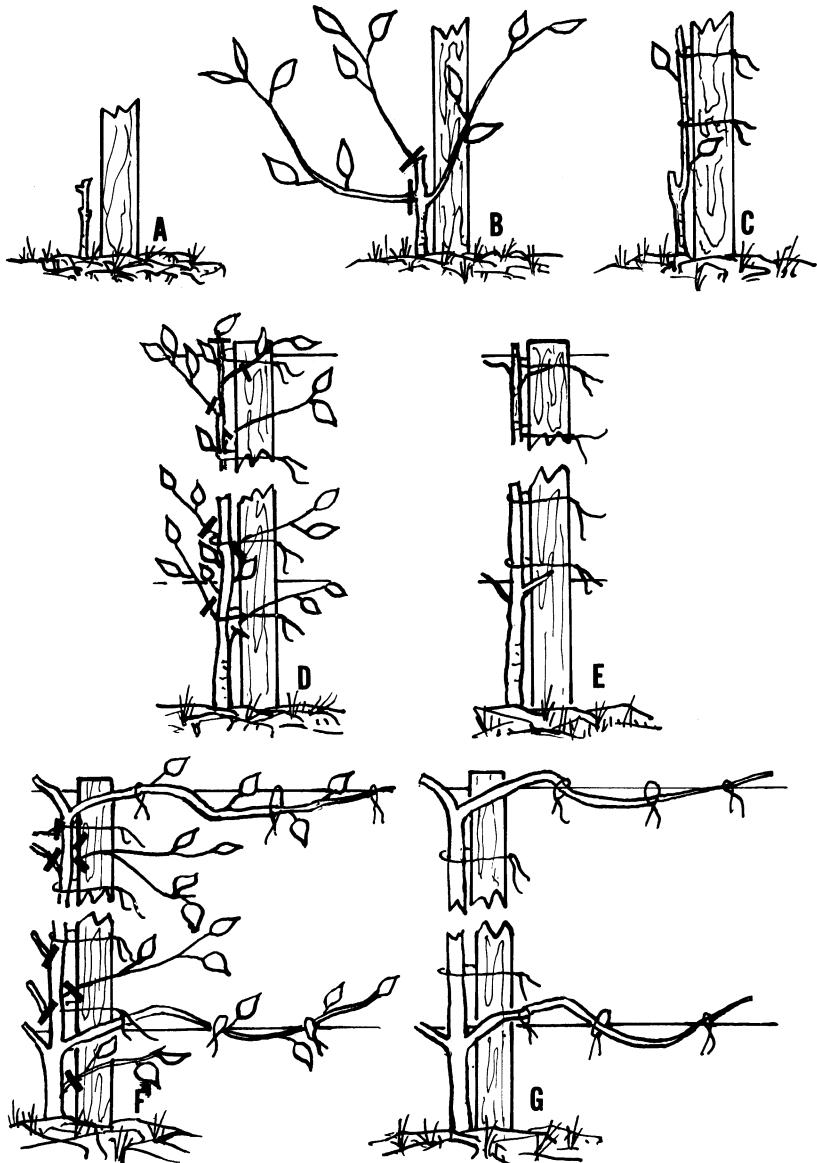
Young Vines

Regardless of the training system, training and pruning during the first years of growth have the same object—to establish as rapidly as possible the main framework, which consists of the trunk and fruiting arms.

If the vines receive good care during this formative period and if growing conditions are favorable, they will bear some fruit the third summer. Neglecting pruning and training during the formative period may delay full bearing for as long as 5 years. Pruning and training of young vines for a vertical trellis is diagrammed in figure 3.

During the first year of growth, pruning and training are the same for an overhead arbor as for a trellis. During the second summer, four canes are trained on four wires of an overhead arbor for future arms. All other shoots are removed during the summer. In the dormant season the vine is pruned to a trunk and four radiating arms at the top. During the third summer, four additional arms are developed on the other four wires, for a total of eight arms. Other growth may be removed during the summer.

The year after the vines are set out, get as much length growth as possible on canes being trained for fruiting arms. They will bear fruit the following year, and that will slow down length growth. If growth is slow or weak during the formative period, cut back to vigorous wood during the dormant season.



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Figure 3.—Pruning and training a young vine on a vertical trellis (pruning cuts are indicated with heavy line): A single stem with two or three buds (A) is planted next to a support stake. When shoots become about 1 foot long (B), all except the best one are cut off, and the remaining shoot is tied to the stake (C). During the first summer a single straight trunk is formed by keeping the selected cane trained up the stake and tied (D), and removing all side shoots as they develop. The tip is pinched out when it reaches the top wire. A single trunk (E) is left after dormant pruning; if side shoots occur below each wire they may be left if shortened to a few buds each. During the second summer, canes are trained for future arms; one each way on each wire (F). Other shoot growth is removed during the summer. After dormant pruning (G), only the frame (trunk and arms) is left.

Bearing Vines

After the framework has been established, prune each year during the dormant season. Cutting back shoot growth is the principal pruning needed during the first few years (fig. 4). Remove all shoots not needed for spurs and fruiting arms. Cut other shoots back to short spurs, each with three or four buds.

As the vines get older, they develop clusters of spurs, or spur systems. Eventually, overcrowding will result unless some of the spurs, or entire clusters of spurs, are removed. Overcrowding causes weak shoot growth, reduced fruit-bud formation, and poor fruit set after flowering. Removing some of the spurs will induce the growth of strong new shoots from the arm. These can then be developed into new spurs to replace older ones.

Shoots should grow to at least three-sixteenths of an inch in diameter and $1\frac{1}{2}$ feet long. If they do not attain this size, it is usually an indication that the vine needs severe pruning, such as thinning the number of spurs per arm, shortening the length of the arm, or removing one or more arms.

Too many vigorous spurs frequently are left at the top of the trunk with both the trellis and overhead arbor systems of training. Prevent this condition by removing most of the spur systems at the top of the trunk.

With the vertical trellis system of training, renew only arms that are no longer vigorous. After a vine on an overhead arbor is 4 or 5 years old and in full bearing, renew one arm each year by cutting off an old arm and training a new cane that arises from the top of the main trunk.

To prevent death by girdling, remove all tendrils that encircle the trunk or arms. Tendrils will also girdle and kill spurs, but the

loss of a spur is comparatively unimportant.

Vines may be pruned at any time during the dormant season, but if they are pruned soon after leaf fall, less bleeding will occur. Late pruning may cause the vine to bleed heavily in mild weather, but there is no evidence that the bleeding injures the vine. The possibility of bleeding should not keep one from pruning.

Corrective Pruning

Muscadine grape vines grow rapidly and become a dense, tangled mass if left unpruned for several seasons. Neglected vines usually have several trunks arising from near the base of the vine. New fruiting shoots develop farther from the base of the plant each year. Eventually, most of the growth is weak and at the extremities of the branches. When vines get in this condition, it is advisable to develop entirely new fruiting surfaces.

If there are 1-year-old canes arising on trunks or arms near the base of the plant, cut back to these canes. It is advisable to reduce the number of trunks to one, or to as few as possible, in this operation. To develop the saved canes into new arms, follow instructions already given for pruning and training.

If there are no 1-year-old canes on the arms in desirable positions for developing new arms—and often there are none on old vines—two methods of renewal may be tried:

1. Cut off all branches; leave only one main trunk. Develop an entirely new fruit-bearing surface by selecting shoots that arise from desirable positions and pruning and training them as you would a young vine.

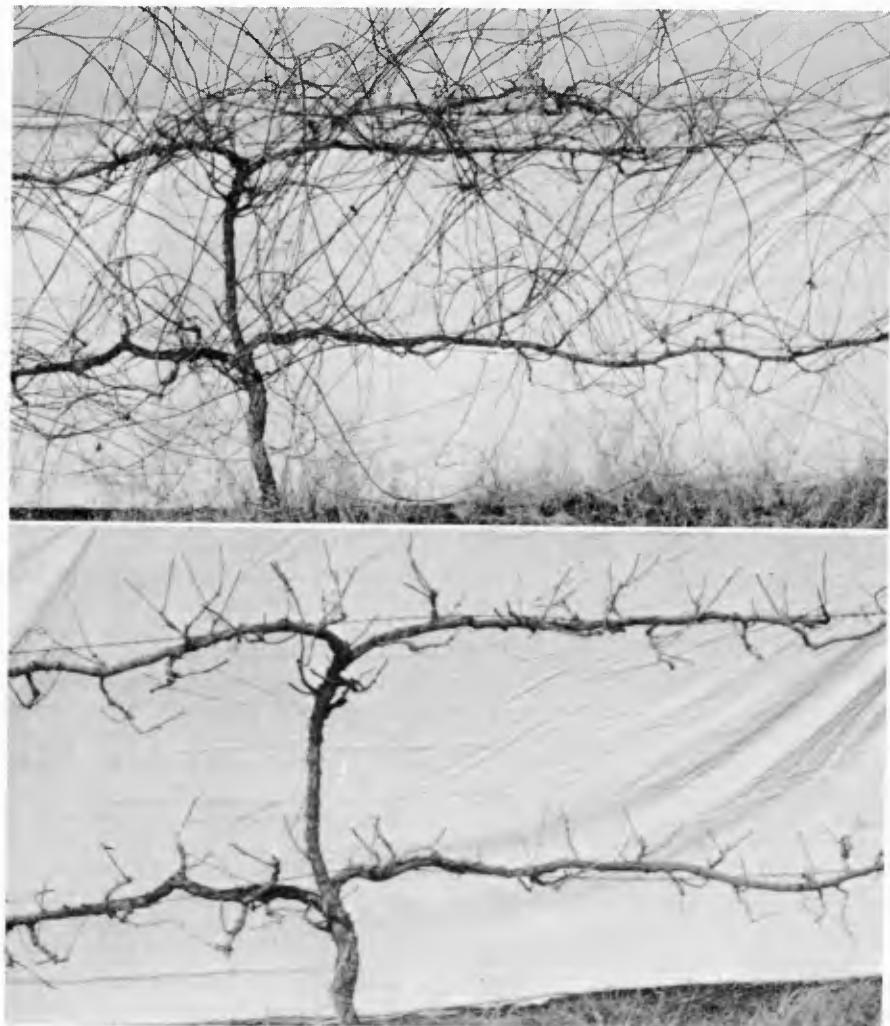
2. Cut off the main trunk or trunks 6 to 12 inches above ground.

Allow new canes to emerge. Select the best cane for a new trunk and remove the rest. Prune and train as though it were a newly planted vine.

Cutting off to a stump often is more successful than pruning back to the main trunk, because it is dif-

ficult to force buds on old wood where they are desired.

If there are several neglected vines that need corrective pruning, total loss of production can be prevented by cutting back only a few of them the first year and waiting for them to come into production before pruning the others.



BN-34911, BN-34912

Figure 4.—Top: A vine during the dormant season, still bearing all the shoot growth of the previous summer. Bottom: The same vine after pruning. (Courtesy of North Carolina State College.)

SOIL MANAGEMENT

If the vines are to be planted on new land, grow a crop requiring cultivation the year before the vines are set out.

During the first 3 years, vineyards usually are clean cultivated during the summer. Low-growing intercrops that require cultivation may be grown; the intercrops will provide some income while the vines are getting established. Plant leguminous winter cover crops in the fall.

After the vines are established, stop intercropping. Continue growing leguminous winter cover crops, such as crimson or burclover, vetch, or peas. Summer management may consist of clean cultivation or trashy cultivation.

Trashy cultivation consists of a light disk in the spring to work part of the winter cover crop top growth into the soil, and intermittent light diskings during the summer to prevent weeds and grass from overgrowing the vineyard. Each disk should cut only part of the vegetation into the ground, so that the land remains rough and trashy with organic matter.

With both methods of cultivation, cultivate lightly to avoid injuring the shallow roots of the muscadine vines.

Another satisfactory cultural method for established vineyards is to maintain a permanent sod crop. With sod culture, mow the vineyard occasionally during the summer. Disk lightly early in the fall to help the leguminous winter cover crop get established.

A chlorosis of muscadine grape leaves due to deficiency of magnesium commonly appears about the time the fruit begins to mature. This is less severe where the vines are grown in sod or given trashy cultivation than where they are given clean cultivation.

FERTILIZATION

Throughout the muscadine region soils are generally deficient in nitrogen, phosphorous, and potash, and crops grown there respond to the addition of these elements.

The main requirement during the first 3 years of vine growth is nitrogen. The rate of application for ammonium nitrate is a total of about $\frac{1}{8}$ pound per vine the first year, $\frac{1}{4}$ pound the second year, and $\frac{1}{2}$ pound the third year. This amount may be divided among two to four applications from March through June. Fertilizer should not be placed nearer than 1 foot from the trunk of the vine.

Little experimental work has been done to determine the fertilizer response of bearing vines. Since there is no specific information, it is probably best to apply a mixed fertilizer. Applications of 600 pounds per acre of a 6-8-8 fertilizer have given good results. In years when the crop is heavy or when plant vigor is low, make a supplementary application in June of 50 pounds per acre of ammonium nitrate or its equivalent.

Regulate fertilizer applications according to the growth of the vine and the set of the fruit. Shoot growth is one indicator of whether the vine is sufficiently nourished to develop good fruit. Shoot growth from the spurs should average at least $1\frac{1}{2}$ feet, but should not exceed 3 feet.

Where the vines are grown in sod, use enough fertilizer to supply both the vines and the grass. A light application will be taken up almost entirely by the grass and will be of little benefit to the vines.

Vineyards on soils that retain fertilizers and moisture are generally fertilized in late winter or early spring (February to April). Sandy soils leach badly; if your vineyard is on sandy soil, fertilize near blossomtime, or make split ap-

plications from April to midsummer. Broadcasting an area 6 to 8 feet on each side of the row is a satisfactory method of application.

Apply barnyard manure if it is available. If the supply is limited, it will do the most good on young vines.

HARVESTING AND HANDLING

Fruit for Processing

Grapes that are to be processed usually are harvested by jarring or stripping onto canvas or burlap sheets spread on the ground. Because fruit harvested this way often has torn skins, and damage is increased as it hits the ground, a picking frame is recommended. Frames work well only if the vines have been well trained and pruned.

The frame is about $2\frac{1}{2}$ by 8 feet, and has hooks at both ends for fastening the frame under fruiting arms. Leave the cloth loose at one end and fold it over the crossbar. Lower this end of the frame when it is full and roll the fruit into containers. Fruit is damaged less in rigid boxes than in large baskets. Remove leaves and other trash by hand or by running the fruit through a fanning mill.

Fruit that is harvested by jarring includes some broken berries. Since it spoils quickly, it must be utilized promptly.

Fruit for Fresh Market

Carefully handpick all fruit that is to be sold on the fresh market. Generally, varieties that shell freely pick with dry scars, and varieties in which fruit holds tightly in the cluster pick with wet scars. If the variety is one in which the berries cling tightly to the cluster, cut the entire cluster from the vine with shears. Berries that shell easily may

be gently picked or pushed off the cluster. If shelled berries have dry skins they are as attractive when packaged as those in clusters; shelled berries with moist scars become wet with juice when packed.

Sorting and grading are essential. The operation is simplified by using a sorting table with a cloth top. Pack only sound, uniformly ripe berries in clean, attractive containers. Market them as soon as possible; they lose moisture and aroma after picking.

If you use berry cups, cover them with a plastic film to keep the fruit fresh and attractive longer. Use perforated plastic to avoid condensation. You can prolong shelf life by holding the fruit at a temperature of 32° to 40° F., but even temperatures of 50° to 60° F. are of some benefit.

DISEASES AND INSECTS²

Muscadine grapes are seldom affected by diseases or insects, and spraying is recommended only when a particular disease or insect becomes a major problem in a vineyard.

Black rot, bitter rot, and angular leaf spot are the three most serious diseases. Black rot produces circular brown spots on the leaves and black, scabby lesions on the fruit, cluster stems, and canes.

Although the fruit is unsightly, it is still usable. Black rot may kill the young flower clusters and thus destroy part of the crop. To prevent this loss, fungicides, such as bordeaux mixture (4:4:100), captan (1 pound actual per 100 gallons) or zineb (1 pound actual per 100 gallons), are applied when new shoots are about a foot long and again just before flowering.

² Information on insects and their control furnished by Entomology Research Division, Agricultural Research Service.

Bitter rot causes berries at all stages of development to decay and shatter, but the most noticeable loss occurs just before maturity. In vineyards where bitter rot is severe, it may be profitable to spray 4 weeks—and again 2 weeks—before harvest with one of the fungicides listed above.

Angular, or cercospora, leaf spot affects the leaves but not the fruit of most muscadine varieties. At first the spots are small, brown, and shaped irregularly. These spots soon enlarge, and a yellow zone forms around each one. A severe infection may cause many leaves to drop.

To control angular leaf spot, spray with any of the fungicides described above at intervals of 2 to 3 weeks during the first half of the growing season. The fungus overwinters on fallen leaves, so remove them from the vineyard or bury them by cultivation before new foliage appears in the spring.

The grape flea beetle, the grape berry moth, and the grape curculio are the most injurious insects. The grape flea beetle, a dark-blue insect about three-sixteenths of an inch long, appears early in the spring and eats out the center of the swollen buds. The eggs soon hatch into tiny worms, which feed on the young leaves. Although this insect is present almost every year, infestations are seldom heavy enough to warrant control measures.

There are several broods of the grape berry moth during the season. The larvae—small, greenish caterpillars—attack the flowers and fruit in all stages of maturity. The most conspicuous injury occurs after the fruit is half grown. The larvae usually enter the fruit where berries touch in the cluster, and feed on the pulp and seeds. The fruit becomes purplish around the puncture.

Grape curculio injury on muscadine grapes is often mistaken for

grape berry moth injury. The eggs are laid within the berry, and the grubs feed on the pulp and seeds, causing the berries to drop. Injury first shows on the fruit as a circular brownish area with a puncture at one side. The color later turns purplish. The puncture is made by the adult curculio in egg laying, and is usually on exposed surfaces of the fruit; berry moth larvae usually puncture where two berries touch.

The grape berry moth can be controlled with azinphosmethyl, carbaryl, diazinon, methoxychlor, or parathion. The grape curculio can be controlled with parathion. Follow the directions on the insecticide label. Do not use azinphosmethyl or parathion in the home garden. Before applying these chemicals in the field, be sure to read the warnings found in the precautions statement on page 14.

VARIETIES

Many varieties of muscadine grapes have limited adaptation or use. Some of these varieties may be preferred for home plantings if they have a characteristic especially valued by the grower. Unless it is known that one of these varieties meets a personal preference, however, it is best to select a popular variety.

Commercial plantings in the Carolinas are primarily Hunt, Thomas, and Scuppernong. In Georgia, Hunt is the leading variety.

Scuppernong is the oldest cultivated variety of American grape. It is thought to have originated in North Carolina. Some vines now growing are more than 150 years old. Scuppernong has been widely disseminated. The name Scuppernong refers only to plants taken directly or indirectly from the original vine and not from the seed. All bronze muscadines are apt to be called Scuppernong throughout

Characteristics of 11 important muscadine grape varieties¹

Variety	Color	Vigor ²	Quality ²	Berry size	Yield per vine	Maturity ³	Sugar as total soluble solids	
					Grams	Pounds	Harvest date	Percent
Burgaw ⁴	Dark	8	6	4.4	74	Sept.	21	15.9
Creek	Dark	10	7	3.9	91	Oct.	5	17.3
Dearing ⁴	Light	8	7	3.4	72	Sept.	27	19.4
Dulcet	Dark	8	8	4.3	87	Sept.	17	18.0
Higgins	Light	7	6	9.6	78	Oct.	1	15.8
Hunt	Dark	9	8	5.5	101	Sept.	17	16.0
Magoon ⁴	Dark	7	7	3.9	55	Sept.	17	17.4
Scuppernong	Light	7	8	5.4	63	Sept.	17	16.1
Thomas	Dark	10	8	4.0	74	Sept.	21	17.3
Topsail	Light	10	10	6.1	45	Sept.	20	19.8
Yuga	Dark	8	7	4.1	64	Oct.	3	17.9

¹ The ratings and figures are mostly from tests and observations at the North Carolina Agricultural Experiment Station at Raleigh, N.C. The vines were trained to an overhead arbor.

² Rating: 2, very poor; 4, poor; 6, good; 8, very good; 10, excellent. A rating of 6 is as low as would be suitable for general planting.

³ Average date of maximum maturity at Raleigh; date would be about 2 weeks earlier in central Georgia and Mississippi. Most varieties have some ripe fruit 10 days before given maximum maturity dates.

⁴ Perfect flowered. Other varieties are pistillate, and require pollinizers.

the area where they are grown, although the fruit may differ greatly from that borne on the original vine. This has led to considerable confusion, and many different selections have been propagated as Scuppernong. Most of those being propagated by the better nurserymen are superior bronze grapes, although they may not be from the original Scuppernong.

Characteristics of some of the more widely grown varieties are given in the accompanying table. The perfect-flowered varieties—Burgaw, Dearing, and Magoon—are recommended for pollinizers and in home plantings for their fruit.

Other varieties worthy of consideration are five perfect-flowered types: Albemarle, Chowan, Magnolia, Pamlico, and Roanoke. All were developed in North Carolina. Bountiful, Chief, and Southland varieties originated in Mississippi,

while Cowart comes from Georgia. These are all recent introductions, and have not as yet been as extensively evaluated as older varieties.

BURGAW.—Perfect flowered. A selection from Thomas, which it resembles. Reddish-black fruit, fair to good in quality. Vine hardy, vigorous, productive, and a good pollinizer.

CREEK.—Late maturing; not recommended in northern part of muscadine region. Reddish-black berries. Rather high in acid, especially when grown in the northern region. Good variety for wine and culinary use. Vigorous and productive vine with medium large fruit clusters.

DEARING.—Perfect flowered. A fine-flavored, late, green grape of medium size, which develops an exceptionally high sugar content. Pulp very firm. Recommended for the upper two-thirds of the muscadine area.

DULCET.—Medium size, black fruit, good quality. Very persistent. Vine of excellent vigor and productivity.

HIGGINS.—An enormous white grape, which has done particularly well in the vicinity of Griffin, Ga. Vine extremely productive in relation to its vigor. Quality fair to good. Because of its size, it outsells other varieties on the fresh fruit market. Only limited plantings should be made, excepting where it has proved to be well-adapted.

HUNT.—Best all-purpose black variety. Large, attractive berries borne in medium to large clusters. Ripens evenly and early. Persistence good. Very productive and dependable vine. A favorite for pies, sauces, jellies, and jams.

MAGOON.—Perfect flowered. A seedling of Thomas, which it resembles in fruit characteristics. Quality good. This variety has been outstanding in the lower parts of the muscadine area.

SCUPPERNONG.—Best known and oldest variety. Clusters usually small, shatters badly. Bronze, medium-large berries, ripens unevenly in midseason. Quality good, distinctive flavor. Vine vigorous. Yields variable with season and location.

THOMAS.—Old standard. Reddish-black, medium to small berries. Very fine, crisp, sweet flavor. Makes particularly pleasing unfermented juice. Vine vigorous and usually productive.

TOPSAIL.—A large, green grape with a very high sugar content and pleasing flavor. Always a favorite, but the vine is often a shy producer. Not always winter-hardy at the upper limits of the muscadine area.

YUGA.—Late maturing; not recommended in northern part of region. Reddish-bronze, high-quality, attractive fruit with thin skin. Large clusters.

PRECAUTIONS

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

Azinphosmethyl and parathion are highly toxic and may be fatal if swallowed, inhaled, or absorbed through the skin. These materials should be applied only by persons who are familiar with their hazards, and who will assume full responsibility for proper use and comply with all the precautions on the labels.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary land-fill dump, or crush and bury them in a level, isolated place.

NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations.